# ASSEMBLY COMMITTEE ON WATER, PARKS AND WILDLIFE
# CALIFORNIA'S SALMON CRISIS:
## Understanding the Severity of the Crisis and the State's Role in Recovery

Testimony of
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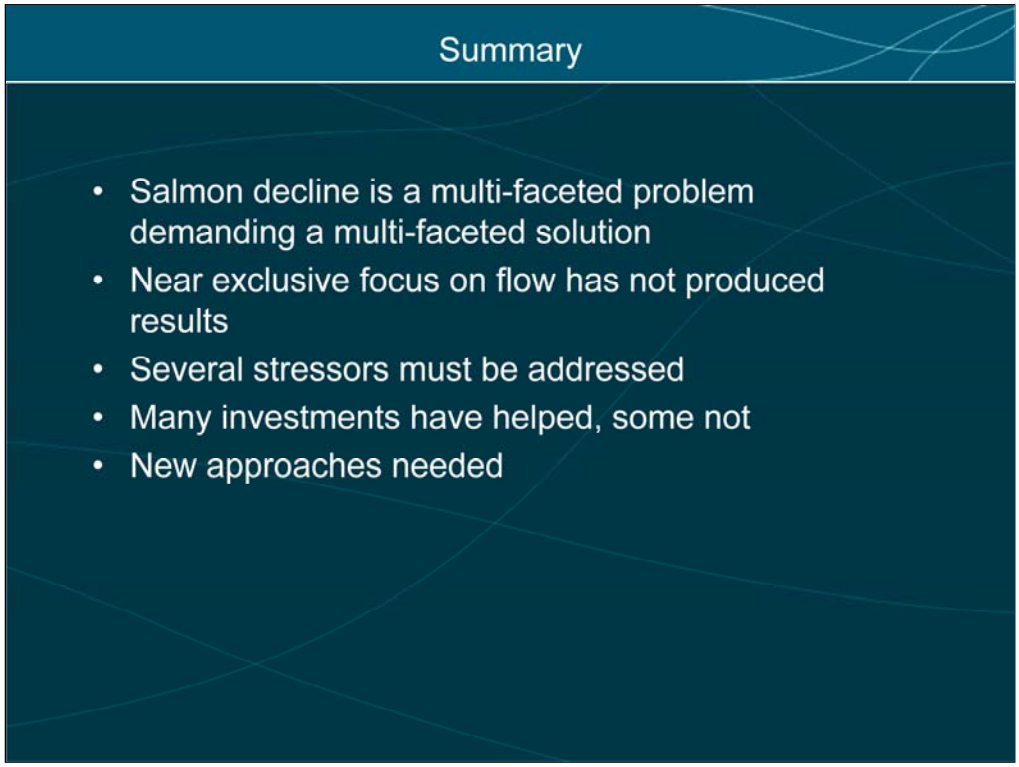


"We predict that the fish communities of [the Delta] will remain numerically dominated by non-native species if the environmental conditions we observed persist in the future."

Source: Feyrer, F. and M.P. Healey 2003. Fish community structure and environmental correlates in the highly altered southern Sacramento-San Joaquin Delta. *Environmental Biology of Fishes* 66: 123-132, 2003

| Salmon Life Stage | Cause of Loss Source | Measures to Minimize Losses | | |
|---|---|---|---|---|
| | | Completed Actions | Now & near-term | Long-term |
| Outmigration - Delta | Predation by Fish | -- | Unlimited harvest of introduced fish. Remove structures. | Unlimited harvest of introduced fish. Remove structures. |
| | Warm water | -- | Minimize heat production - more shade | Minimize heat production - more shade |
| | Toxics | -- | Identify and control | Identify and control |
| | Food shortage | Wetland restoration | Restore wetlands | Restore wetlands |
| | Diversions | Reduced exports, closed DCC more | BiOp will reduce export pumping | Build and operate a Peripheral Canal |
| Ocean rearing | Warm water | | Minimize heat production - shade | Minimize heat production - more shade |
| | Food shortage | Wetland restoration | Wetland restoration | Wetland restoration |
| | Harvest listed salmon | Time and area exclusions | Total marking and selective fishery | Total marking and mark selective fishery |
| Spawning | Harvest wild or listed salmon | Time and area exclusions | Total marking and mark selective fishery | Total marking and mark selective fishery |
| | Habitat access | Provided streamflows, removed small dams | Streamflows for attraction and passage | Streamflows for attraction and passage, build the PC, habitat restoration, passage over dams |
| | Competition for space and mates | Segregated Butte Creek for spring run | Total marking and mark selective fishery | Total marking and mark selective fishery, exclude hatchery fish from streams |
| | Less fecund or fertile | -- | Total marking and hatchery use of unmarked spawners. | Total marking and hatchery use of unmarked spawners, exclude hatchery fish from streams. |
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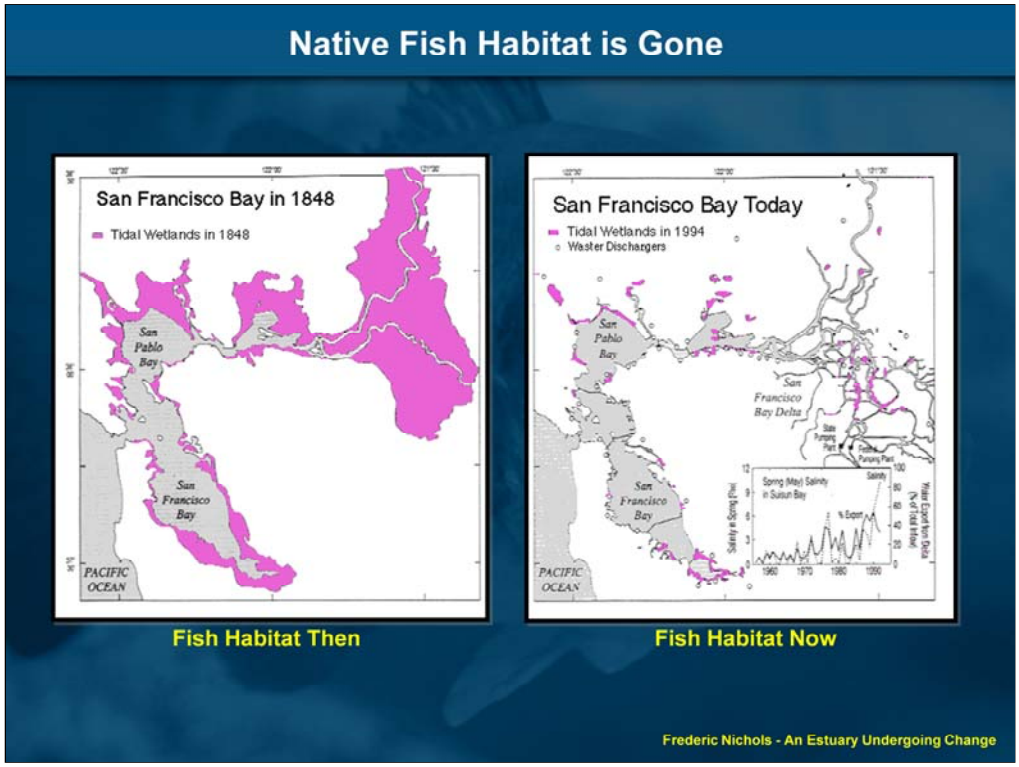
Salmon face hazards at all life stages (egg & incubation, larval rearing, out-migration in rivers, out-migration in Delta, ocean rearing, in-migration, and spawning. We have addressed some loss factors. Major unaddressed factors are habitat loss in the Delta, and the dominance in the ecosystem by non-native competing and predator species. Unless these factors are aggressively addressed, recovery is unlikely.

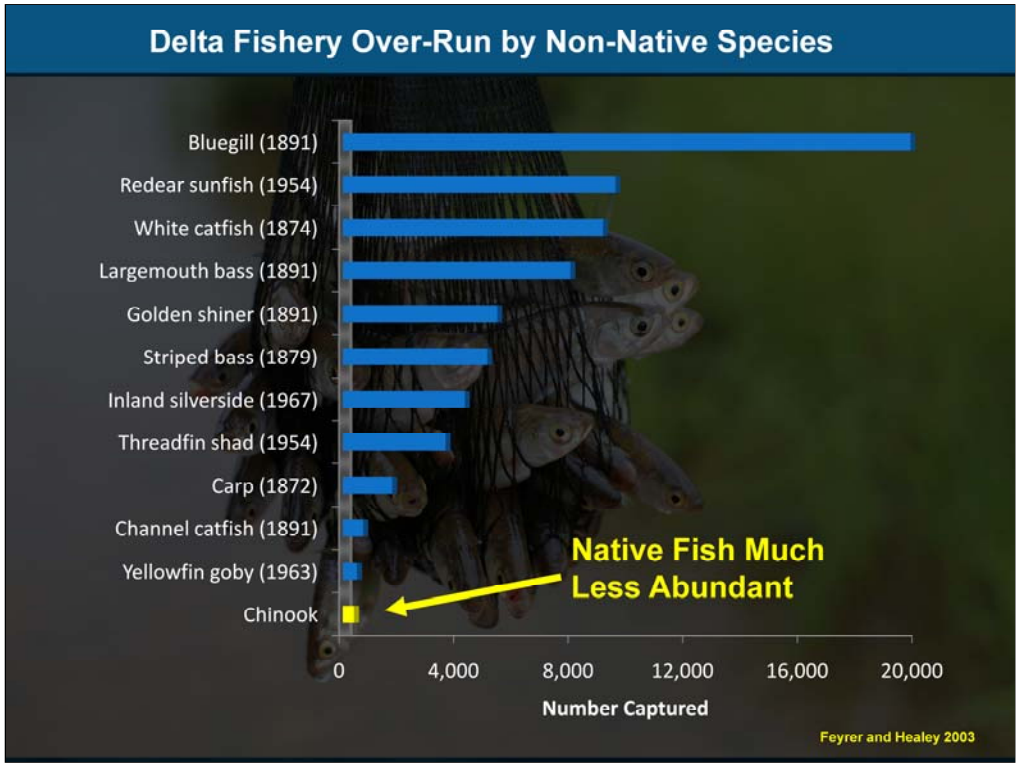



Perhaps the most obvious and dramatic change in the Delta is the widespread loss of shallow water habitat, vital nursery areas for juveniles of almost all fish species, but especially native species such as salmon. Shallow water habitat is also important for primary and secondary producers, the organisms at the base of the food chain that ultimately provide food for native fish. Upstream habitat losses are equally problematic.

Recovering wetlands can also address other goals, such as raising the elevation of subsided Delta island to reduce catastrophic flooding due to levee failure and to sequester carbon to reduce climate change.

Source: The San Francisco Bay and Delta - An Estuary Undergoing Change, Frederic H. Nichols
http://sfbay.wr.usgs.gov/general_factsheets/change.html

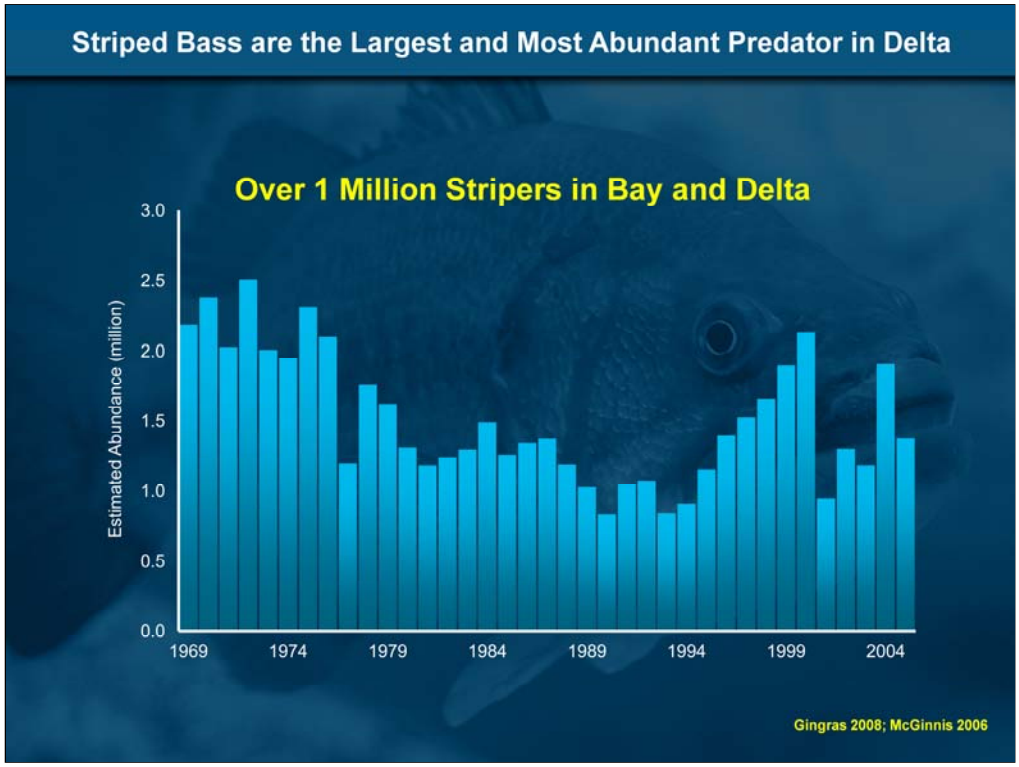
USGS. Carbon Capture Farming, A new future for subsided Delta lands?
http://ca.water.usgs.gov/news/carbon_briefing.pdf




In almost a decade of fish sampling in the south Delta, the 11 most abundant fish captured were non-native species. In this study, which is consistent with other Delta studies, the overwhelming majority of the biomass consisted of non-native fish species. The total biomass of the Delta is about the same as it always has been, but the native species have been replaced with non-natives.

Many of these species compete with native fish, such as juvenile salmon, for limited food and space. Others are known to be significant predators that prey on salmon smolts as they move through the Delta.

Source: Feyrer, F. and M.P. Healey 2003. Fish community structure and environmental correlates in the highly altered southern Sacramento-San Joaquin Delta. *Environmental Biology of Fishes* 66: 123-132, 2003

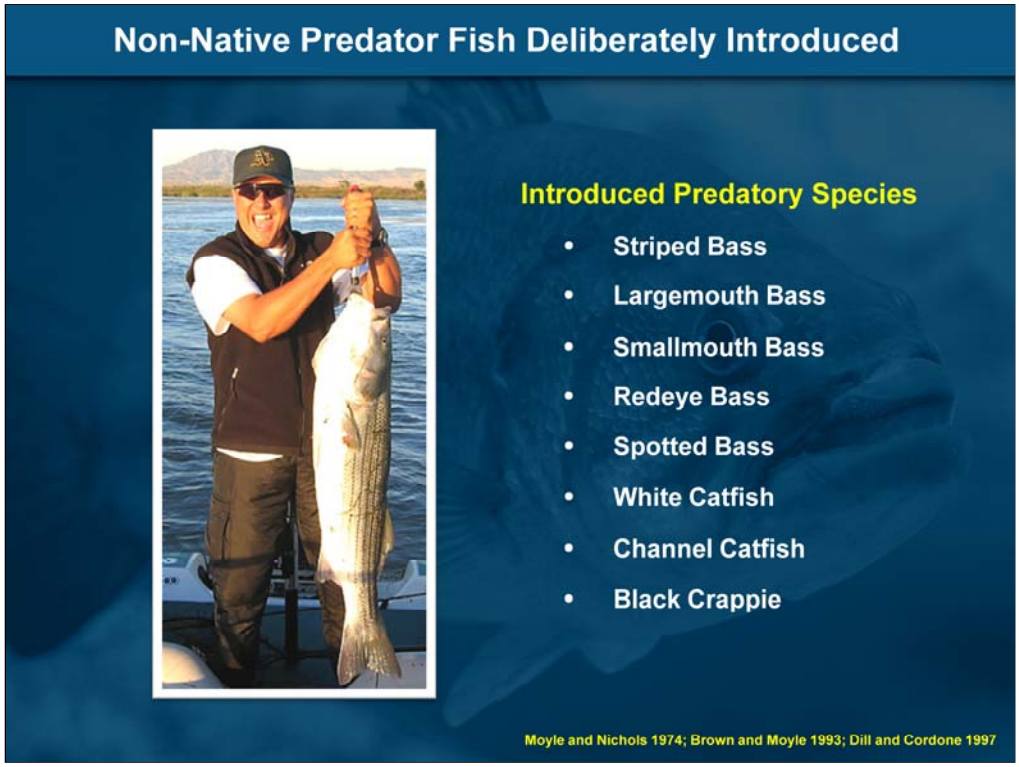



Striped bass were first introduced in the Delta in 1879, and were so successful that by 1890 there was a commercial fishery underway. As Professor McGinnis notes in his recent *Field Guide to Freshwater Fishes of California*, prior to the 1870's the Delta had no large, pelagic predator that fed voraciously during a long annual stay in freshwater.

Today, although the myth persists that the striped bass population is collapsing, the California Department of Fish and Game estimates that there are over 1 million stripers in the Delta. Their abundance remains high, even though in 1992 the stocking of striped bass in the Delta was curtailed due to concern over predation on the endangered winter-run Chinook salmon.

Gingras M. 2008. DFG Striped Bass Population estimates and stocking data. KNB Data Registry: http://knb.ecoinformatics.org/knb/metacat/nceas.908.2/nceas


Striped bass predation is high where fish are concentrated, confused, or disoriented. These hot spots are places such as Clifton Court Forebay, channel scour holes, and artificial structures (e.g. bridges, piers, and diversion and discharge pipes) .




Historically, the Delta consisted of approximately 29 native fish species, few of which were significant predators of other fish.

The native fish communities of the valley floor, which the aboriginal populations relied on as a source of food, have been almost completely replaced by non-native species.

Although none of these original fish populations were significant predators, today the Delta and lower tributaries are full of large non-native predators that were deliberately introduced into the Delta by the California Department of Fish and Game.

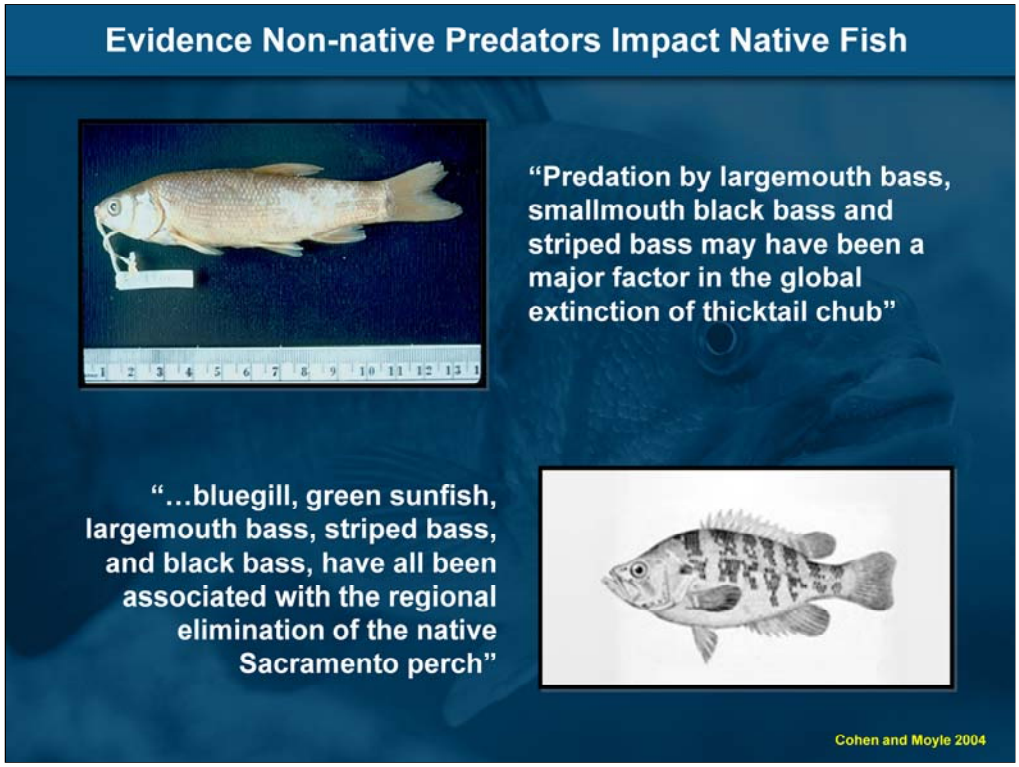
All of the top predators responsible for preying on native fish are currently managed with angling gear, season, and size regulations to maintain or increase their abundance.

Sources:

Moyle, P. B., and R. Nichols. 1974. Decline of the native fish fauna of the Sierra Nevada foothills, central California. The American Midland Naturalist 92(1):72-83

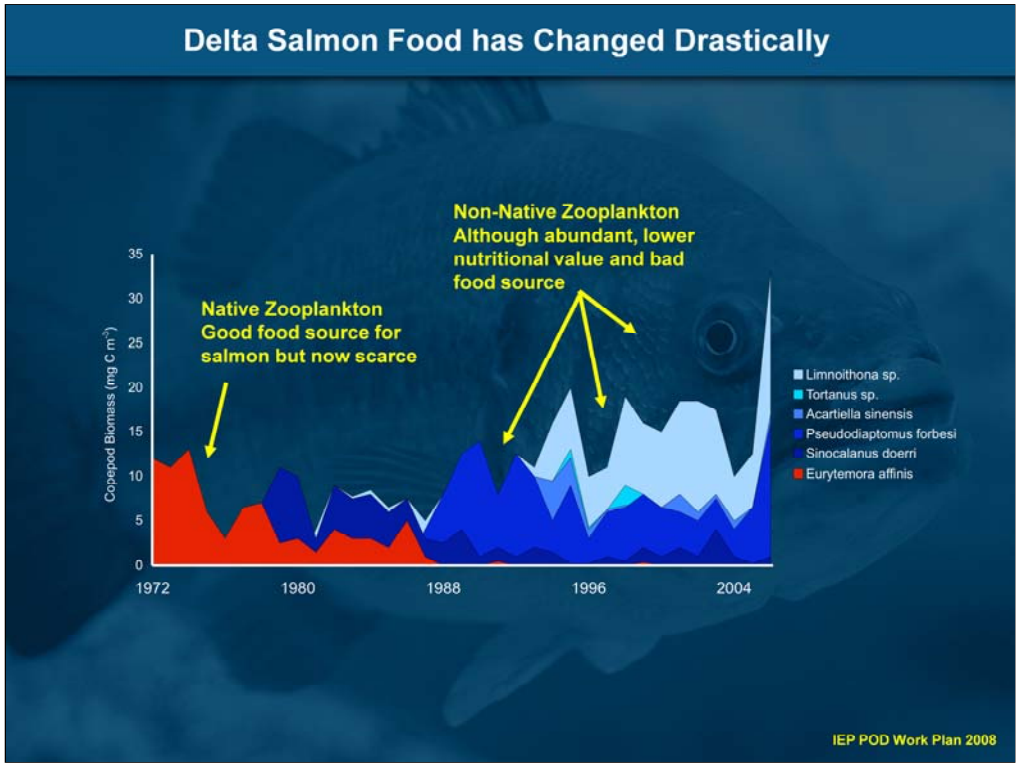
Brown, L. R., and P. B. Moyle. 1993. Distribution, ecology, and status of the fishes of the San Joaquin River drainage, California. California Fish and Game 79:96-113

Dill, W. A. and A. J. Cordone. 1997. History and status of introduced fishes in California, 1871-1996. Fish Bulletin 178: 1-414. California Department of Fish and Game.




It is well documented that non-native species harm native fish populations, through competition for food and space, and predation.

Source: Cohen, A.N. and P.B. Moyle. 2004. Summary of data and analyses indicating that exotic species have impaired the beneficial uses of certain California waters. A report submitted to the State Water Resources Control Board. June 2004. http://www.sfei.org/bioinvasions/Reports/2004-ImpairedCalWaters382.pdf




Juvenile salmon feed on zooplankton, but the delta food web is now dominated by non-native species.

Native zooplankton species have been replaced by non-native species, some thought to be less available as prey and with lower nutritional value than native zooplankton.

These significant changes in food resources have the potential to limit native fish production, and according to new research by the Interagency Ecological Program, "the weight of evidence strongly supports bottom-up food limitation as a factor influencing long-term fish trends in the upper estuary."

Source of graph: Baxter R., R. Breuer, L. Brown, M. Chotkowski, F. Feyrer, B. Herbold, P. Hrodey, A. Mueller-Solger, M. Nobriga, T. Sommer, and K. Souza. June 2008. Interagency Ecological Program 2008 Work Plan to Evaluate the Decline of Pelagic Species in the Upper San Francisco Estuary. http://www.science.calwater.ca.gov/pdf/workshops/POD/IEP_POD_2008_workplan_060208.pdf

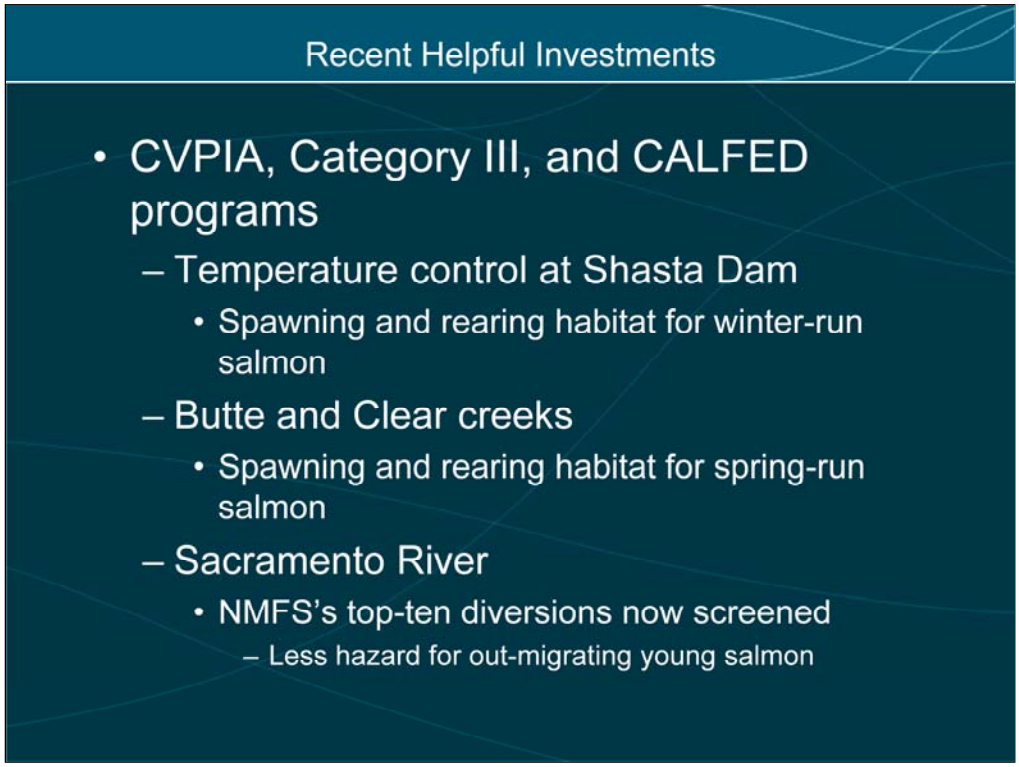

Fish hatcheries produce 31 million juvenile fall-run Chinook salmon annually and hatchery fish compose up to 90% of the ocean catch. Hatcheries mitigate for habitat lost to dams and water diversions. Yes, hatchery salmon are often underused by fisheries because the harvest is restricted to protect wild Chinook salmon. Ironically, excess hatchery fish then compete for limited habitat and interbreed with wild stocks on spawning grounds.

With marking every hatchery fish, they would be visibly distinguishable from wild salmon. Fisheries could harvest hatchery salmon even when mixed with wild stocks. Wild fish would be released, and allowed to return to spawn.

Total marking would likely cost approximately $6.3 million annually.

“Marking all salmon released from hatcheries is an important tool for salmon conservation in the Pacific Northwest. We are not using it enough in California. We should.” – Peter Moyle and Richard Sitts, Sacramento Bee, Aug 9, 2008.

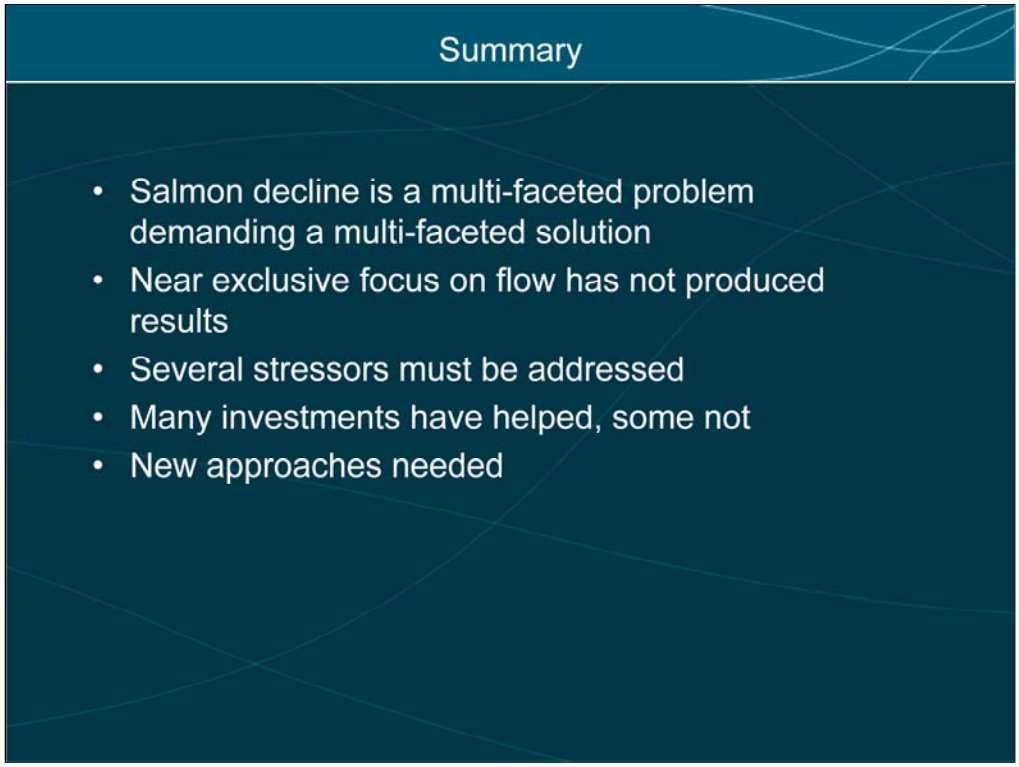
Total marking programs already occur in Oregon, Washington, and British Columbia, plus all states and provinces abutting the Great Lakes.




On Butte Creek, in the 15 years before the approximately $30 million in projects, a total of 6,000 fish. In the 15 years after, an average of 6,000 each year.

## But Some Investments Are Not Performing

- Spawning habitat improved on Tuolumne and Merced rivers
  - But fish populations still low
  - Due to predation by non-native species

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